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Enterprise Service Bus – A Strategy and Infrastructure for Critical Systems of Systems Integration

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Background and Motivation

- Dramatic increase in distribution and complexity of software systems

    - Business/Enterprise Systems

    - Technical/Embedded Systems

- Shift from stand-alone to networked systems

- Internet/Wireless Networks have become key enabling technologies for advanced services

- Convergence between business and technical systems:

    - Telecommunication/Networking

    - Web Services

    - Embedded Systems

- Systems of Systems – at all levels

Service-Oriented Applications

Tool Support

Tailored Development Processes

Service-Oriented Software Architectures

Expressive Description Techniques

Precise, Methodological Foundation
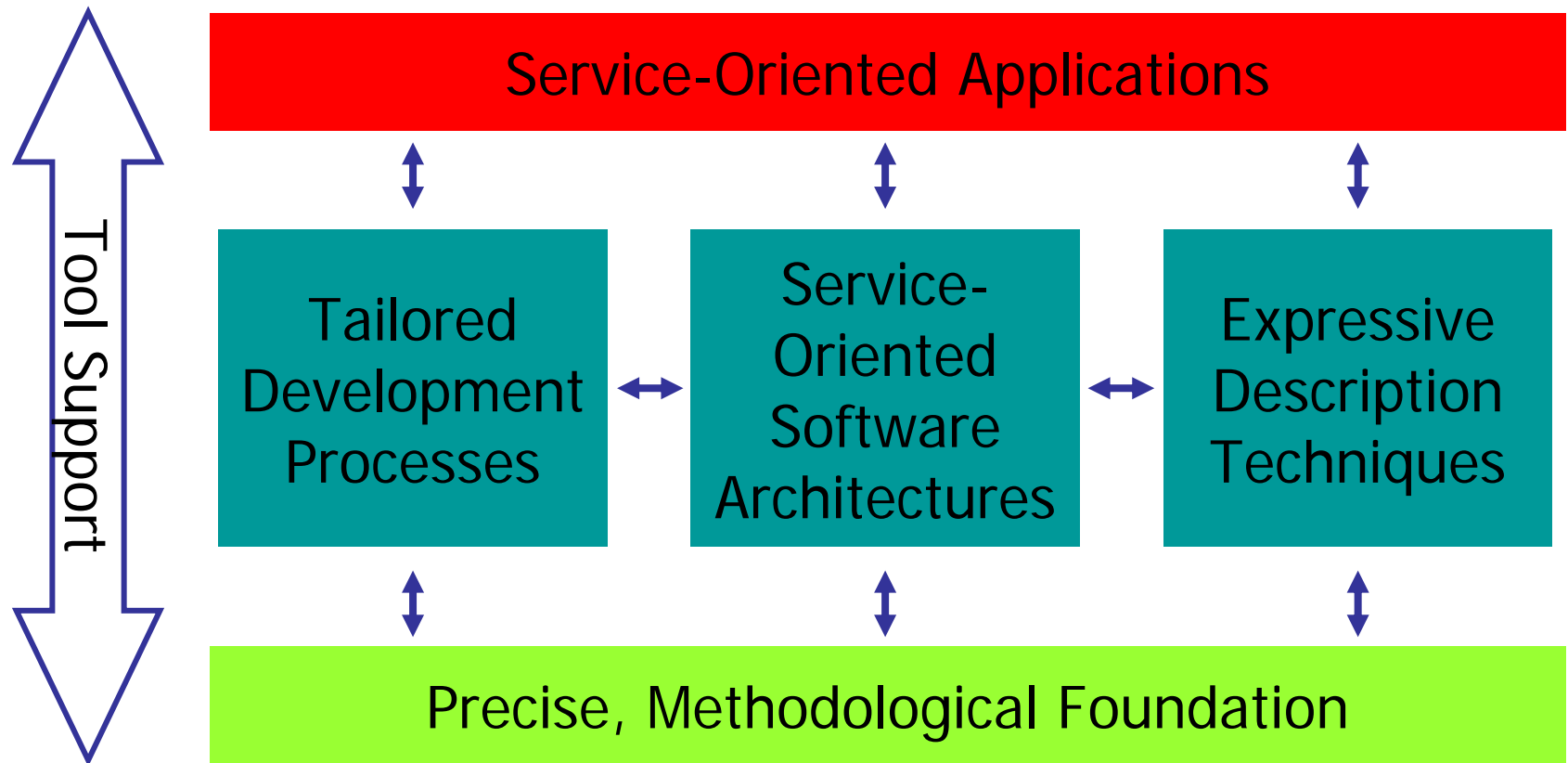
Example: BioNet

- Effective consequence management of Bio Event

- Cooperative program between DHS and DTRA

- Objectives:

  - Develop interoperable military and civilian concepts of operation

  - Integrate military and civilian capabilities to detect and characterize bio event

  - Provide common situational awareness to ensure timely, effective, and consistent response

- Large Scale Systems of Systems Integration
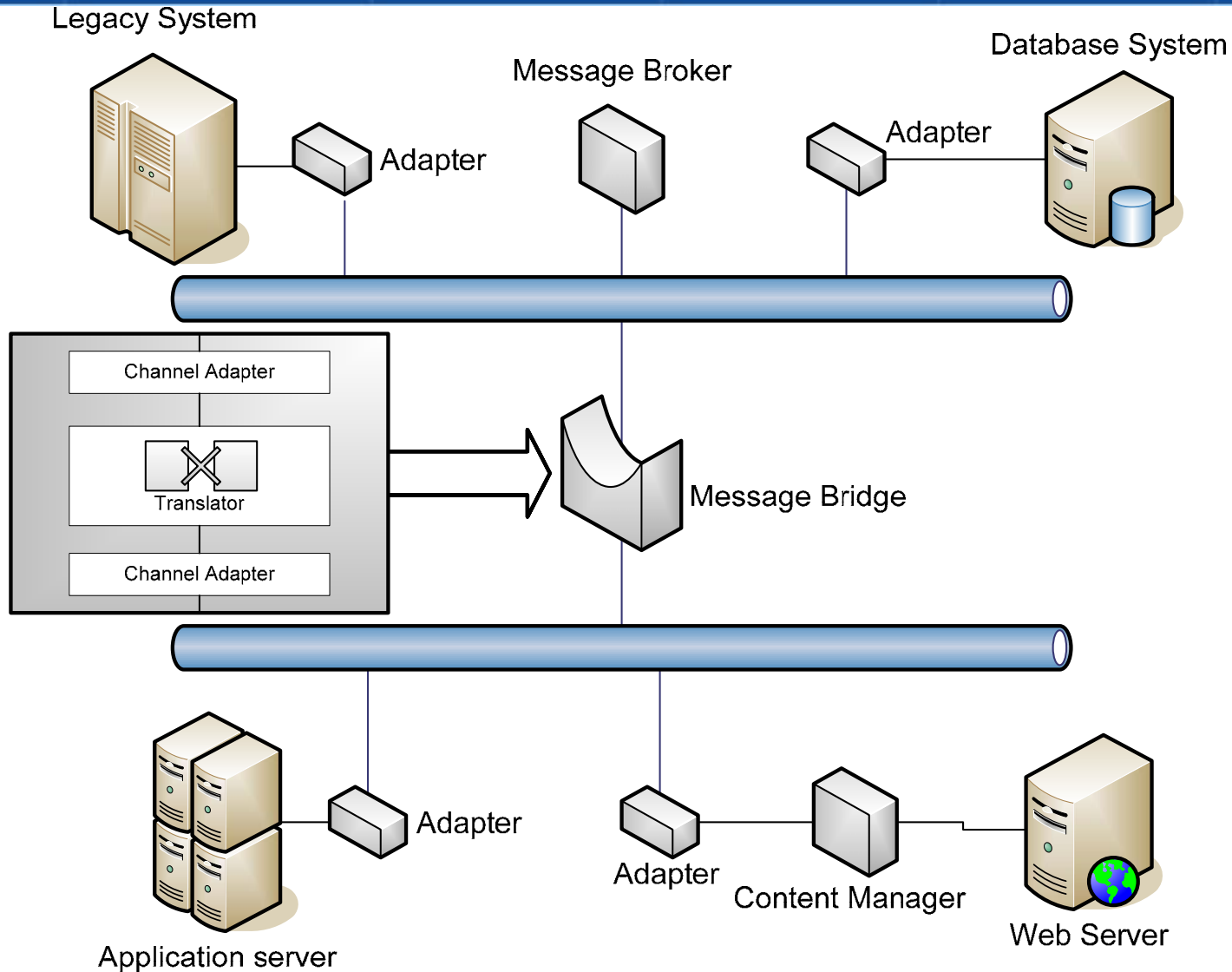
Example: Integration Needs in BioNet

Presentation

Security Privacy

Data
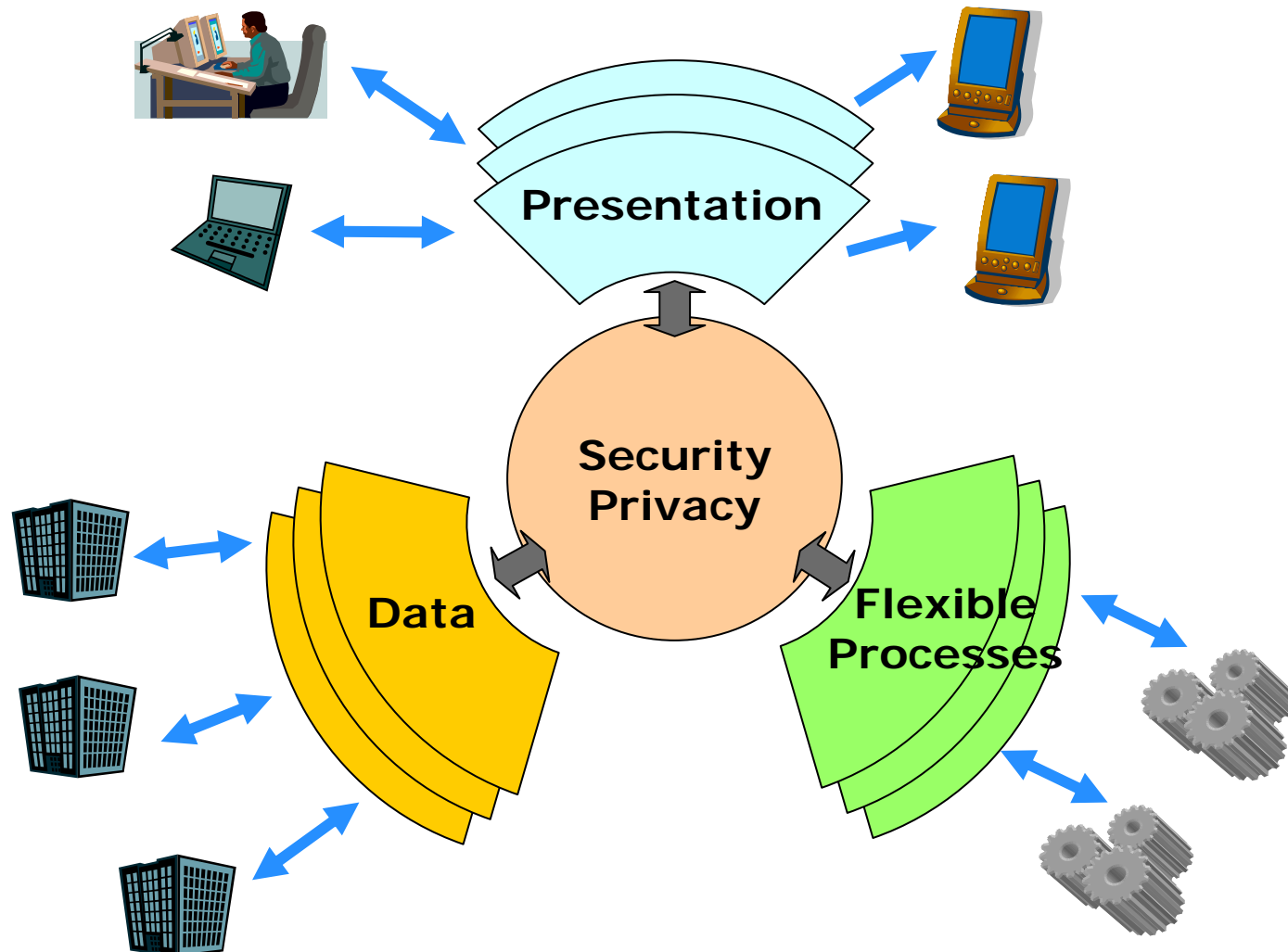
Flexible Processes

Rapid, Iterative and Incremental Software and Systems Integration
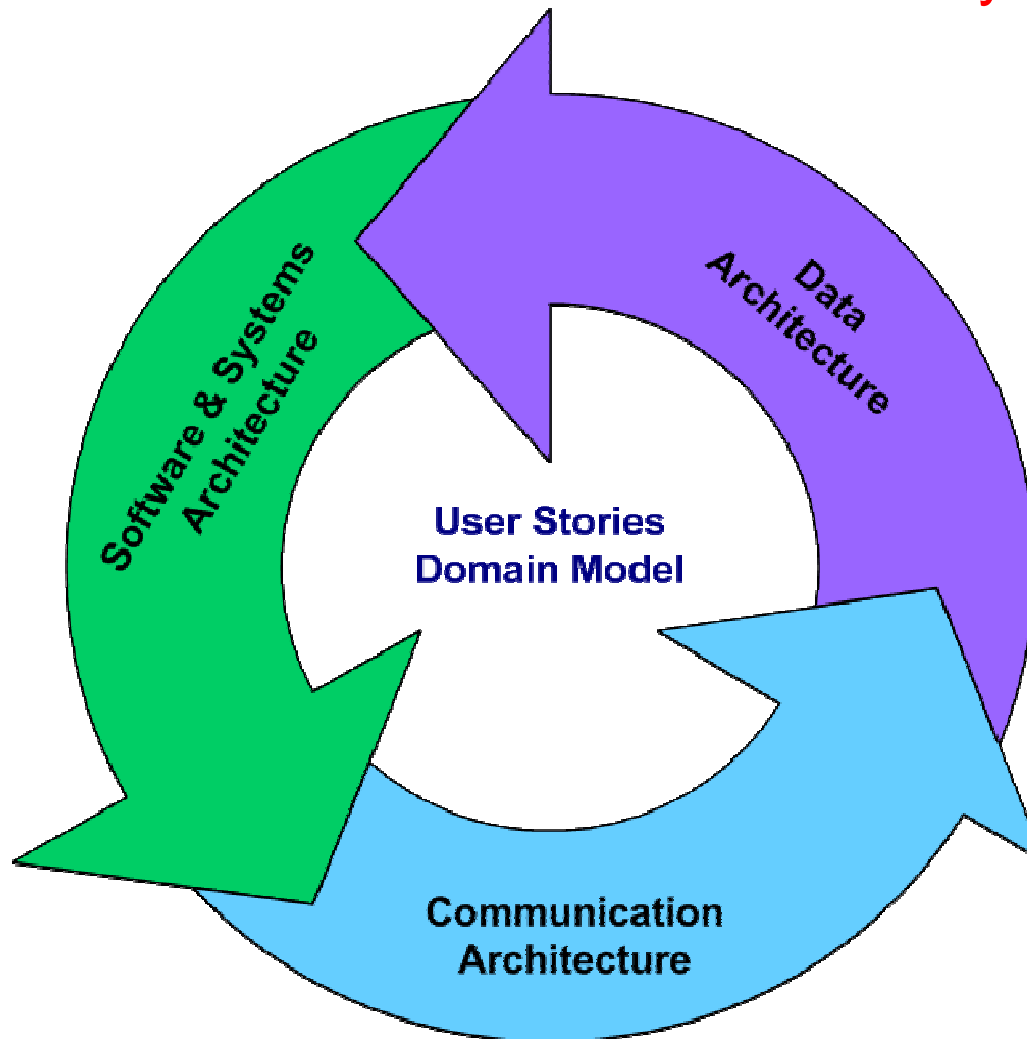
Message/Service Bus Architecture

- **Loosely Coupled**

- **Event-Driven**

- **Highly Distributed, Scalable**

- **Security/Authorization**

- **Abstract Endpoints**

- **Intelligent Routing**

- **Data Transformation (inbound/outbound)**

- **Reliable Messaging**

- **Multi-Protocol Message Bus**

- **Light Weight**

- **Service container and messaging platform**

- **Supports a variety of topologies including ESB**

- **Highly Scalable; uses SEDA event model**

- **Transactional; Local and Distributed**

- **Fault tolerance; Exception management**

- **Secure; authentication/authorization (Using Spring/Acegi)**

- **Powerful event routing capabilities**

- **Support for over 20 messaging protocols/transports**

- **End-to-End Data Transformation**

- **Management and Monitoring using JMX**

- **BPEL support**

- **Addresses the basic need to move any kind of data (not just XML) between services in an organization**

- **Deployment: JAR, WAR, RAR, EAR.**

Summary/Lessons Learned

- Service-Orientation addresses important needs in systems of systems integration

- Requires mastery of
  - Development Process
  - Architectures
  - Infrastructures
  - Applications and Application Domains

- Enterprise Service Bus
  - IT infrastructure for flexible, secure, scalable, rapid systems integration

Summary/Lessons Learned

- Applicable across application domains:
  - Defense
  - Homeland Security
  - Command and Control
  - Automotive
  - Telecommunications
  - Healthcare
  - …
- Calit2 engaged in software and systems architecture and integration projects
  - BioNet
  - RESCUE
  - WIISARD
  - RUNES/Sensor Networks
  - …

Software and Systems Architecture and Integration Capability: CALIT2 SAINT Team

- Development and implementation of service- and message-oriented software and systems architectures using proven integration technology.

- Design and implementation of flexible and scalable solutions such as XML-based Web services, web-portals, message busses.

- Use of COTS products, commercial and open source (IBM WebSphere, Groove, .Net, DMIS, JBOSS)

- Technology configured for secure, reliable, trustworthy information exchange under stress.

- Successful integration on large-scale software and systems integration efforts, including decision support system and national template architecture for BioNet.

- Use of DoD Architecture Framework (DoDAF), Federal Enterprise Architecture (FEA), Rational Unified Process Architecture (RUP), and others.

- Tailoring (software) development processes, such as EIA-632, RUP, SCRUM, and XP for scalable, highly iterative, incremental goal-, customer- and user-centric system development and integration.